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Braunheim et al.

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(54) **FILTER DEVICE**

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(58) **Field of Classification Search**

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(56) **References Cited**

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U.S. PATENT DOCUMENTS

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3,312,350 A * 4/1967 Kasten 210/307
3,465,883 A * 9/1969 Jumper 210/307

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(Continued)

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FOREIGN PATENT DOCUMENTS

(87) PCT Pub. No.: **WO2011/032818**

DE 3941996 A1 6/1991
DE 19951085 A1 4/2001

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(Continued)

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OTHER PUBLICATIONS

US 2012/0234743 A1 Sep. 20, 2012

English Translation of DE 10 2005 000 658 A1.

(Continued)

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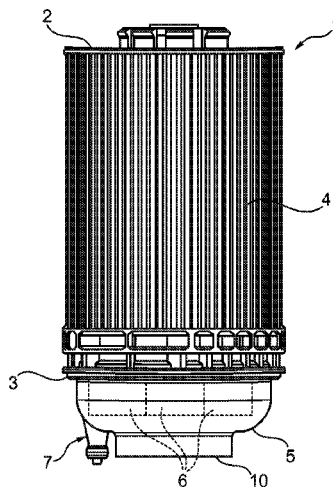
(57) **ABSTRACT**

A filter device may include a ring filter element arranged in a filter housing in an upright manner. The ring filter element may have an upper end disc and a lower end disc. A dirt pot may have a water separator arranged therein and be provided on the lower end disc. The dirt pot may also have a protruding pin. A channel may be configured to receive the pin and be provided on at least one of a filter housing pot and a functional element. The filter device may be operational when the pin engages into the channel.

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21 Claims, 3 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

3,502,218	A	3/1970	Tuttnell	
4,497,714	A *	2/1985	Harris	210/788
4,502,955	A *	3/1985	Schaupp	210/149
4,619,764	A *	10/1986	Church et al.	210/248
5,089,129	A	2/1992	Brigman	
5,548,893	A	8/1996	Koelfgen	
6,139,738	A *	10/2000	Maxwell	210/248
6,409,804	B1	6/2002	Cook et al.	
7,237,681	B2	7/2007	Brieden et al.	
7,527,739	B2 *	5/2009	Jiang et al.	210/702
2005/0274664	A1 *	12/2005	Stoehr et al.	210/299
2007/0084776	A1 *	4/2007	Sasur	210/314
2007/0240390	A1	10/2007	Becker et al.	
2008/0024719	A1	1/2008	Kamishita et al.	
2009/0008321	A1	1/2009	Tanner et al.	
2011/0017649	A1 *	1/2011	Sasur	210/232
2011/0089091	A1 *	4/2011	Grass et al.	210/90

FOREIGN PATENT DOCUMENTS

DE	10308427	A1	9/2004
DE	102005000658	A1	7/2006
DE	102005015194	A1	10/2006
DE	202006006084	U1	8/2007

DE	202006017305	U1	3/2008
DE	102007048550	A1 *	4/2008
DE	102007009352	A1	8/2008
EP	0260069	A2	3/1988
EP	0385113	A2	9/1990
EP	0405447	A2	1/1991
EP	1233173	A2 *	8/2002
EP	1695753	A1	8/2006
WO	WO-2006105755	A1	10/2006
WO	WO 2009/080455	A1 *	7/2009

OTHER PUBLICATIONS

Abstract of DE 103 08 427 A1.
 Abstract of DE 10 2007 039679 A1 equivalent application to DE 20 2006 017 305 A1.
 Abstract for DE 39 41 996 A1 of equivalent application EP 0433664.
 Abstract of DE 10 2007 009 352 A1.
 Abstract of DE 199 51 085 A1.
 Abstract DE 10 2005 015 194 A1.
 Abstract JP 7217577.
 International Search Report PCT/EP2010/062585, dated Dec. 6, 2010.
 English abstract for EP-0385113, Sep. 5, 1990.
 Search Report for EP-10751600.7, Jun. 14, 2003.

* cited by examiner

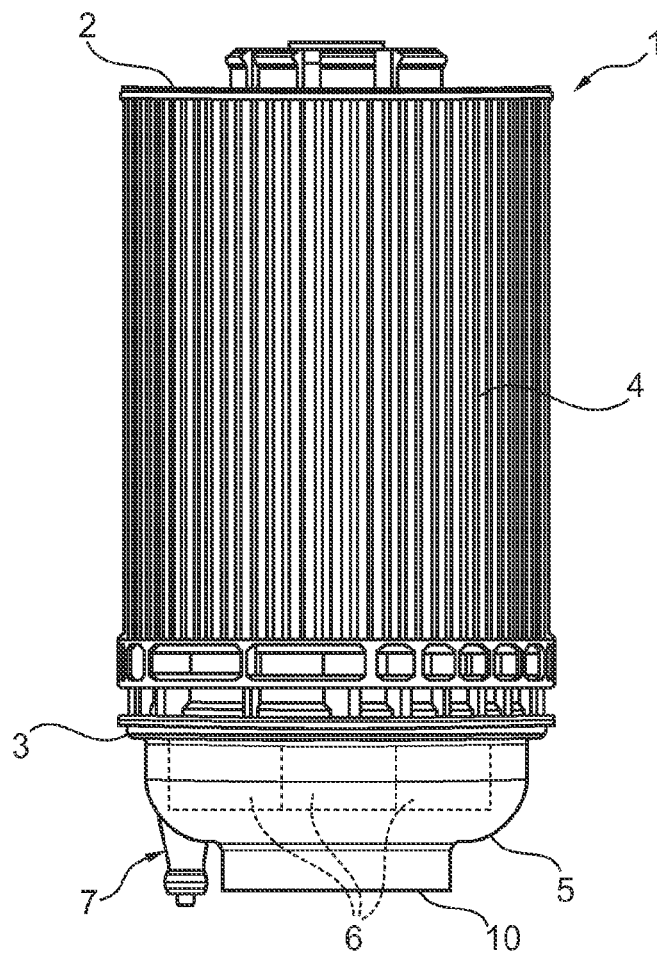


Fig. 1

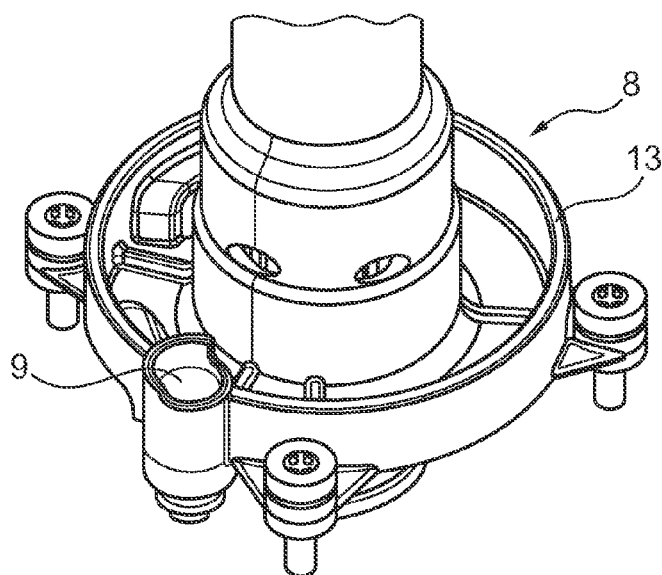


Fig. 2

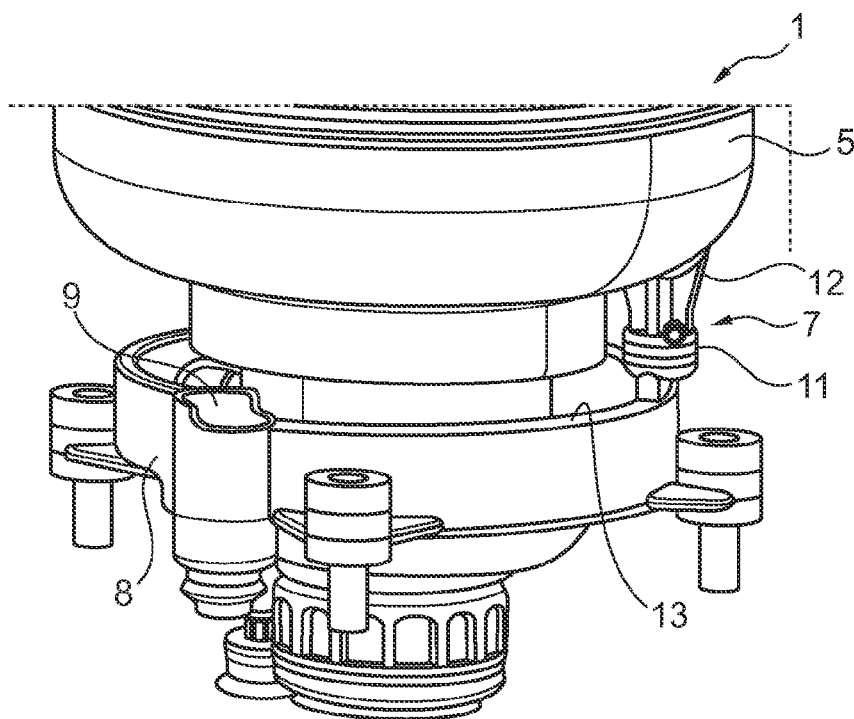


Fig. 3

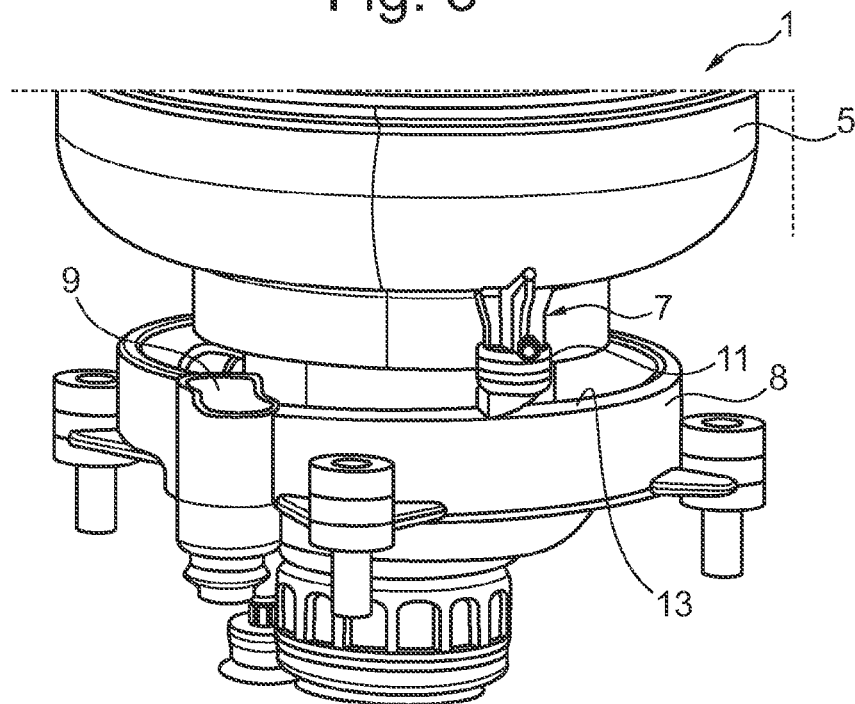


Fig. 4

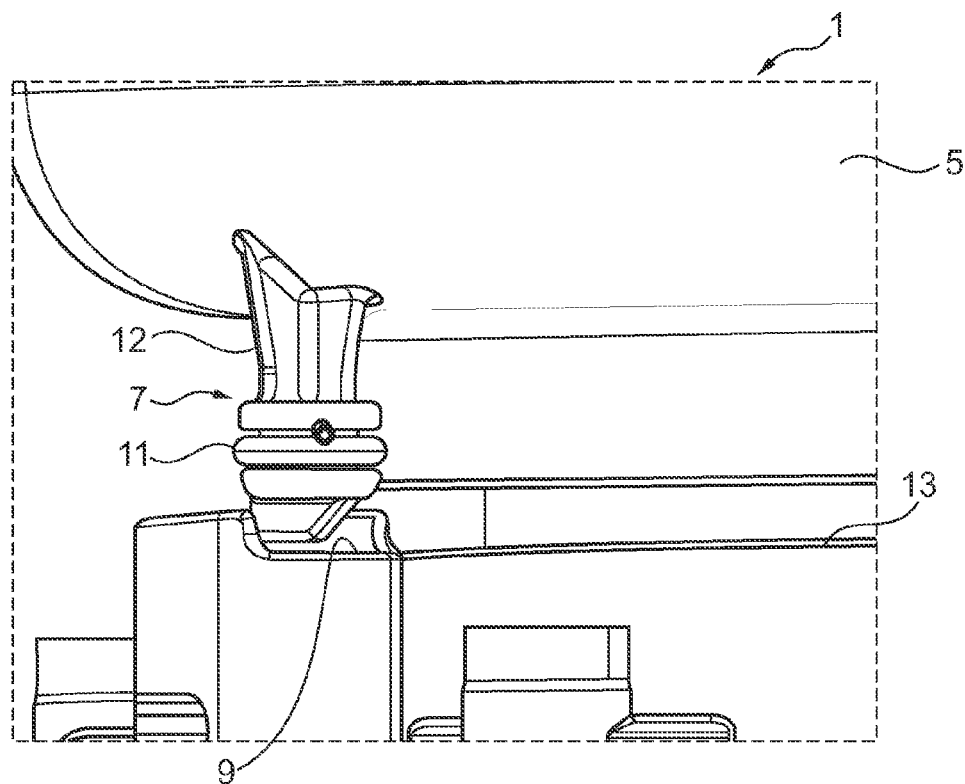


Fig. 5

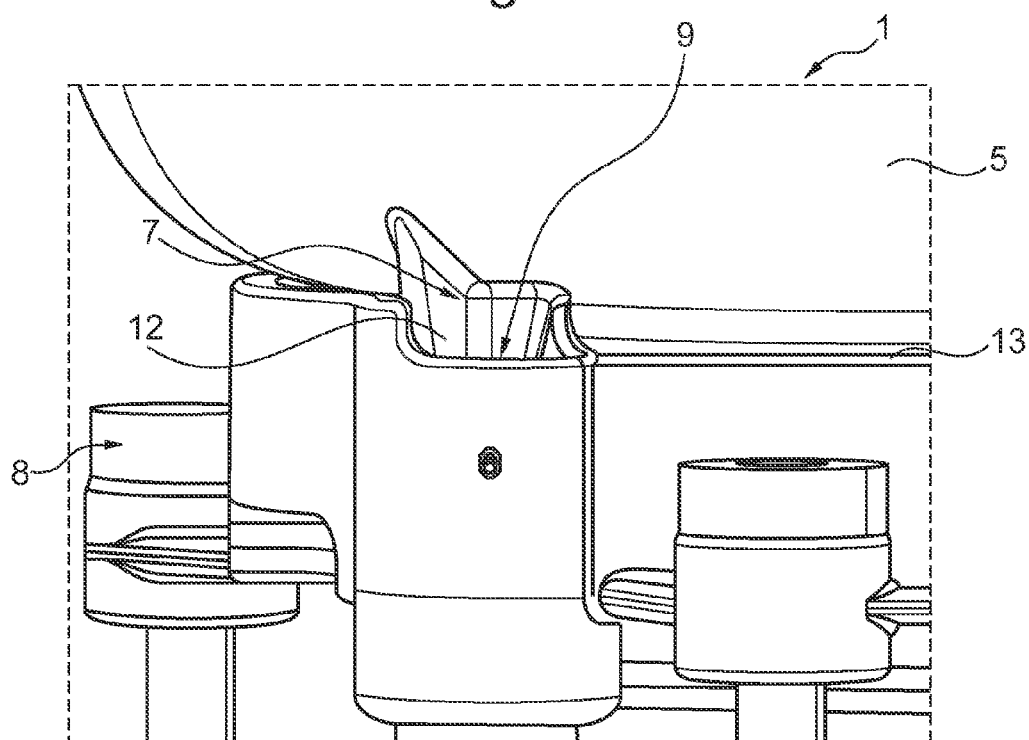


Fig. 6

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FILTER DEVICE**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims priority to German Patent Application 10 2009 041 523.8 filed on Sep. 15, 2009 and PCT/EP2010/062585 filed on Aug. 27, 2010, which are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

The present invention relates to a filter device having a ring filter element arranged in a filter housing in an upright manner, which ring filter element has an upper and a lower end disc, in accordance with the introductory clause of Claim 1. The invention further relates to a ring filter element for such a filter device.

BACKGROUND

A generic filter device is sufficiently known and is to be found in almost all modern motor vehicles, used for example as an oil- or fuel filter.

In order to be able to guarantee a problem-free filter effect, it is often important for the manufacturers of such filter devices that only filter elements which have been authorized or produced by them are used. With the use of filter elements of external brands or imitations, namely not only can be filter performance be impaired, but at the same time also damage can be caused. On the other hand, it is desirable to be able to produce and offer filter elements for such filter devices at as favourable a cost as possible.

The present invention is therefore concerned with the problem of providing for a filter device of the generic type an improved or at least an alternative embodiment, which in particular enables exclusively the use of authorized filter elements.

This problem is solved according to the invention by the subjects of the independent claims. Advantageous embodiments are the subject of the dependent claims.

SUMMARY

The present invention is based on the general idea of providing a ring filter element, known per se, which is arranged in an upright manner in a filter housing of a filter device, with a dirt pot on the base side, on which a protruding, nozzle-shaped pin is constructed, by which the ring filter element engages into a channel provided on a filter housing pot or on a functional element, in so far as the ring filter element is correctly mounted. The dirt pot is arranged here on the lower end disc of the ring filter element, wherein the socked-shaped pin is constructed in one piece with the dirt pot, and an operation of the filter device is then enabled exclusively in so far as the pin of the dirt pot engages into the channel on the filter housing pot side or respectively on the functional element side. The dirt pot and hence also the socked-shaped pin are preferably constructed here in one piece or in one part with a lower end disc of the ring filter element, in particular the dirt pot is welded onto the lower end disc of the ring filter element, for example by means of friction welding, ultrasonic welding or laser welding. A water separator is provided in addition inside the dirt pot, so that the dirt pot per se can be used both as a dirt-collecting chamber and also as a water-collecting chamber, and has on the base side at least one outlet for collected dirt or respectively for collected water. With the

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filter device according to the invention it is therefore possible that it can only be used in so far as ring filter elements which fit it are used with the pin on the dirt pot side; the use of other ring filter elements by which under certain circumstances the filter performance of the filter device could be impaired, can therefore be reliably prevented.

In an advantageous further development of the solution according to the invention, the water separator which is arranged inside the dirt pot is constructed as a coalescer and at the same time is welded onto the lower end disc of the ring filter element. Such a coalescer is able to collect and divert water particles and therefore for example to filter out water components present in the fuel, so that these can not arrive into the combustion engine and cause corrosion damage there. In this case, the filter device can be constructed for example as an oil- or fuel filter, wherein quite generally a construction as an air filter is also conceivable. The water separator is connected here to the lower end disc of the ring filter element, in particular is welded on, and can thereby be exactly positioned and fixed before the assembly or respectively before the closing of the dirt pot, which distinctly simplifies the manufacturing process of the filter device according to the invention.

In a further advantageous embodiment of the solution according to the invention, a guide is provided on the filter housing pot or on a functional element arranged therein, along which guide the pin of the dirt pot is guided on mounting of the ring filter element to the channel. Such a guide can be constructed for example in the manner of an incline, which enables an arbitrary insertion of the ring filter element, so that the latter slides by means of the pin along the guide into the channel and thereby a correct mounting can always be guaranteed. Such a guide can be realized on the one hand at a favourable cost, for example by a suitable injection mould, and on the other hand guarantees a distinctly simplified handling of the filter device according to the invention, because the ring filter element can be inserted into the filter housing pot in an arbitrary rotation angle position and can be transferred by a simple twisting into its proper and correct position. An incorrect mounting of the ring filter element can be thereby reliably ruled out.

Further important features and advantages of the invention will emerge from the subclaims, from the drawings and from the associated description of the figures with the aid of the drawings.

It shall be understood that the features mentioned above and to be explained in further detail below are able to be used not only in the respectively indicated combination, but also in other combinations or in isolation, without departing from the scope of the present invention.

Preferred example embodiments of the invention are illustrated in the drawings and are explained in further detail in the following description, wherein identical reference numbers refer to identical or similar or functionally identical components.

BRIEF DESCRIPTION OF THE DRAWINGS

There are shown, respectively diagrammatically:
 FIG. 1 a ring filter element according to the invention, in a side view,
 FIG. 2 a view onto a functional element,
 FIG. 3 a cooperation of the ring filter element with the functional element,
 FIG. 4 an illustration as in FIG. 3, but with a different rotation angle position of the ring filter element,

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FIG. 5 a detail illustration of a pin, projecting in a nozzle shape, of the ring filter element before immersion into an associated channel,

FIG. 6 an illustration as in FIG. 5, but after the immersion of the pin into the channel.

DETAILED DESCRIPTION

In accordance with FIG. 1, a ring filter element 1 according to the invention has an upper end disc 2 and a lower end disc 3. Between the two end discs 2 and 3 a filter material 4 is arranged, for example in the manner of a pleated star. The ring filter element 1 is arranged here in a similar manner to the illustration in FIG. 1 in an upright manner in a filter housing, not shown, of a filter device, for example an oil- or fuel filter. According to the invention, on the lower end disc 3 a dirt pot 5 is now provided, having a water separator 6 arranged therein and only sketched by a dashed line. A nozzle-shaped pin 7 is provided protruding downward on the dirt pot 5, which pin is constructed in a complementary manner to a channel 9 constructed on the filter housing pot, which is not shown, or on a functional element 8 (cf. FIG. 2) which is able to be inserted into this filter housing pot which is not shown. An operation of the complete filter device is then possible here exclusively in so far as the pin 7 engages into the channel 9, which can be constructed in particular as an idle channel.

Generally, the water separator 6 can be constructed as a so-called coalescer and can be welded to the lower end disc 3 of the ring filter element 1. The welding can take place for example by means of ultrasonic welding, friction welding or laser welding and guarantees a reliable positioning and fixing of the water separator 6 on the lower end disc 3 of the ring filter element 1, so that in a subsequent working step the dirt pot 5 can be connected with the end disc 3, in particular welded. Of course, a welding of the water separator 6 to the lower end disc 3 after the welding of the dirt pot 5 to the lower end disc 3 is also conceivable, wherein in this case the water separator 6 must be subsequently introduced through an opening 10 of the dirt pot 5 on the base side.

On viewing FIGS. 1 and 3 to 5, it can be seen that on the pin 7, i.e. in particular on its pin head, at least one sealing element 11 is arranged which tightly closes the channel 9 with the pin 7 engaging therein. The at least one sealing element 11 can be constructed here for example as a conventional O-ring seal. On viewing FIG. 5, it can be seen that the pin 7 has a shaft 12 which is cruciform in cross-section, and that the pin has the previously mentioned pin head adjoining thereto, wherein the cross-section profile of the shaft 12 gives the pin 7 a high degree of rigidity. For the correct introduction of the pin 7 in the channel 9, a guide 13 can be provided on the filter housing pot or on the functional element 8, with which guide in the best case the pin 7 slides along with low friction to the channel 9. The guide 13 can be constructed here for example in the manner of an incline.

The invention not only relates here to a complete filter device, consisting of filter housing and filter housing pot and functional element 8 arranged therein and ring filter element 1, but also to the ring filter element 1 as a separate component, in particular for the spare parts market. Through the construction of the ring filter element 1 in one piece together with the dirt pot 5 and in particular through the construction of the pin 7 and of the dirt pot 5 in one part, a complete part can therefore be produced, in particular also for the spare parts market, which on the one hand is favourably priced and which on the other hand guarantees that no unsuitable and non-authorized brands are used, which can weaken the filter performance and thereby, under certain circumstances, can cause damage. Of

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course, both the pin element 7 and also the dirt pot 5 can be constructed here from favourably priced plastic, in particular as a plastic injection moulded part. In the illustrations, the channel 9 is constructed as an idle channel.

The invention claimed is:

1. A filter device comprising:

a ring filter element arranged in a filter housing in an upright manner, the ring filter element having an upper end disc, a lower end disc, a filter material arranged between the upper end disc and the lower end disc, and a dirt pot having a separate water separator arranged therein and provided on the lower end disc, the dirt pot having a protruding pin and an opening on a base side of the dirt pot, the dirt pot being configured to be inserted into a filter housing pot of the filter device, and

a functional element, the functional element having a channel configured to receive the pin, a portion of the functional element being configured to penetrate the opening of the dirt pot, the portion of the functional element further having at least one discharge opening,

wherein the filter device is operational when the pin engages into the channel.

2. The filter device according to claim 1, wherein the water separator is constructed as a coalesce and is welded onto the lower end disc of the ring filter element.

3. The filter device according to claim 2, wherein the dirt pot is welded onto the lower end disc of the ring filter element.

4. The filter device according to claim 1, wherein the filter device is constructed as at least one of an oil filter and a fuel filter.

5. The filter device according to claim 1, further comprising at least one sealing element arranged on the pin, the sealing element configured to tightly close the channel with the pin engaging therein.

6. The filter device according to claim 1, further comprising a guide arranged on at least one of the filter housing pot and the functional element and configured to guide the pin into the channel.

7. The filter device according to claim 5 wherein the pin has a shaft having cruciform cross-section and a pin head adjoining thereto, further wherein the at least one sealing element is arranged in a region of the pin head.

8. A ring filter element for a filter device comprising:

an upper end disc and a lower end disc,

a filter material arranged between the upper end disc and the lower end disc, and

a dirt pot provided on the lower end disc and having a separate water separator arranged therein and provided on the lower end disc, wherein the dirt pot has a protruding pin and an opening on a base side of the dirt pot configured to receive a portion of a functional element, wherein the pin is configured to engage in a channel provided in the functional element such that the filter device is operational.

9. The ring filter element of claim 8, further comprising at least one sealing element arranged on the pin, the sealing element configured to tightly close the channel with the pin engaging therein.

10. The ring filter element of claim 9, wherein the pin has a shaft having cruciform cross-section and a pin head adjoining thereto, further wherein the at least one sealing element is arranged in a region of the pin head.

11. The ring filter element of claim 8, further comprising a guide arranged on the functional element and configured to guide the pin into the channel.

12. The ring filter element of claim 8, wherein the water separator is constructed as a coalesce and is welded onto the lower end disc of the ring filter element.

13. The ring filter element of claim 8, wherein the dirt pot is welded onto the lower end disc of the ring filter element. 5

14. The filter device according to claim 1, wherein the dirt pot is welded onto the lower end disc of the ring filter element.

15. The filter device according to claim 14, wherein the filter device is constructed as at least one of an oil filter and a fuel filter. 10

16. The filter device according to claim 14, further comprising at least one sealing element arranged on the pin, the sealing element configured to tightly close the channel with the pin engaging therein.

17. The filter device according to claim 2, further comprising at least one sealing element arranged on the pin, the sealing element configured to tightly close the channel with the pin engaging therein. 15

18. The filter device according to claim 17, wherein the pin has a shaft having cruciform cross-section, and a pin head adjoining thereto, further wherein the at least one sealing element is arranged in a region of the pin head. 20

19. The filter device according to claim 2, further comprising a guide arranged on at least one of the filter housing pot and the functional element and configured to guide the pin into the channel. 25

20. The filter device according to claim 1, wherein the dirt pot having the water separator arranged therein operates as a dirt-collecting chamber within at least a portion of the dirt pot and a water-collecting chamber within the water separator. 30

21. The filter device according to claim 6, wherein the guide is an incline along which the pin slides to the channel.

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